PATENT

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Title of the Invention: TANK CLOSURE

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Cross-Reference To Related Applications And Claim To Priority

This application claims priority pursuant to 35 U.S.C. § 119 to application number 103 17 851.1-25, filed April 16, 2003 in the Federal Republic of Germany.

Field Of The Invention

The invention concerns a tank closure comprising a tank cap and an electrically conductive tank neck, the tank cap having, for handling thereof, a grip portion made of electrically conductive material that is in electrical contact with at least one resilient contact projection that, in the screwed-on state, rests against the tank neck in order to discharge static electricity.

Background Of The Invention

If a tank cap is not electrically conductive and also has no electrical connection to the tank neck, the problem exists that the tank cap can become electrically charged if it is handled by a person who is charged with static electricity, for example by rubbing against plastic seats while getting out. This can result in sparking and thus an explosion of the fuel vapor that flows out of the tank neck upon removal of the tank cap.

To prevent this, it is known in the existing art to fabricate the grip portion of the tank closure from an electrically conductive material, for example from a plastic such as polyamide mixed with carbon (graphite), and to create an electrical contact between the grip portion and tank cap when the tank cap is screwed onto the neck. The static electricity transmitted from a user to the grip portion is thus transferred to the tank neck and discharged to the chassis, so that when the tank cap is unscrewed, a potential difference no longer exists between the tank cap and tank neck, and the risk of sparking is accordingly diminished.

To bring about electrical contact between the grip portion and tank neck, it is known in the existing art to attach a separate contact ring made of electrically conductive plastic in the region of the lower edge of the grip portion, by clipping it in (EP 1 079 832 A2; EP 0 926 199 A1). The contact ring has inwardly projecting, lug-like, resilient contact projections that, when the tank cap is screwed onto the tank neck, come into contact with

the latter. Electrical contact between the tank neck and contact ring is brought about via these contact projections. The contact ring itself is in electrical contact with the grip portion because of its attachment thereto.

It has been found with the known solutions that the discharge of static electricity from the grip portion to the tank neck is unsatisfactory, i.e. that a potential difference continues to exist between the tank cap and tank neck despite mutual electrical contact. The reason for this is evidently that contact resistances, which prevent rapid and complete potential equalization, must be overcome both at the connection between the grip portion and contact ring, and in the region where the contact projections rest against the tank neck.

Summary Of The Invention

It is the object of the invention to embody a tank closure of the aforesaid kind in such a way that the greatest possible potential equalization is achieved between the tank cap and tank neck, and the risk of sparking is thus reduced to a minimum.

According to the present invention, this object is achieved in that the contact projection or projections is or are shaped onto or molded into the inner side of the grip portion. Shaping can be achieved by molding, in particular injection molding, onto the grip portion, in particular when the contact projection and grip portion are made of electrically conductive plastic.

The basic idea of the invention is thus not to provide a separate transfer ring with contact projections for electrical contact between the grip portion and tank neck, but rather to mount the contact projections directly on the grip portion, specifically by shaping them on or molding them in, so that an intimate connection between the contact projection and grip portion is produced, eliminating any contact resistance. It has been found that a substantially better and faster potential equalization between the grip portion and tank neck is thereby achieved, and sparking prevention is thus enhanced. Manufacture of the tank closure according to the present invention is moreover substantially simpler and uses less material, so that manufacturing costs are not inconsiderably reduced.

It is furthermore proposed according to the invention that the contact projection or projections be embodied in the manner of a leaf spring, and protrude radially obliquely inward. By appropriate adaptation to the conformation of the tank neck, the respective

contact projection can be made to rest against the tank neck with sufficient preload, and the contact resistance is accordingly low. It is particularly advantageous in this context if the contact projection or projections, viewed in a circumferential direction, protrude radially obliquely inward beginning on the inner side of the grip portion, in the manner of a ramp. This allows large contact forces to be achieved without thereby making it substantially more difficult to screw the tank cap in or out. The underside of the contact projection or projections should, in this context, be pulled up toward the free end and chamfered, since this promotes and assists placement of the contact projections onto the end face of the tank neck, and thus radially outward pivoting of the contact projections.

According to a further feature of the invention, it is provided that the inner side of the grip portion comprises, in the region of the contact projection or projections, recesses such that the respective contact projection fits into the recess upon radial outward motion. A long deflection travel is thus made available to the contact projections, promoting their ability to adapt to the conformation of the tank neck. The contact projection or projections should be respectively shaped on a rim of the recess.

The present invention is not limited as regards the number of contact projections. It has proven useful to arrange two contact projections located diametrically opposite one another. This does not exclude the provision of only one contact projection, or of more than two.

Description Of The Drawings

The invention is illustrated in more detail, with reference to an exemplary embodiment, in the drawings, in which:

FIG. 1 is a vertical section through a tank closure according to the present invention;

FIG. 2 is an oblique side view from below of the grip portion of the tank closure shown in FIG. 1; and

FIG. 3 is a vertical section through the grip portion shown in FIG. 3.

Detailed Description Of The Preferred Embodiments(s)

Tank closure 1 depicted in FIG. 1 comprises the upper end of a tank neck 2 made of metal, and a tank cap 3 screwed thereinto. The tank cap has an engagement part 4 that externally comprises a thread 5 that fits into a corresponding thread 6 on the inner side of tank neck 2. A hat-shaped grip portion 7 having an elevated grip flange 8 is slipped over engagement part 4. In the upper region, engagement part 4 is surrounded by a sealing ring 9 that rests sealingly on the end face of tank neck 2. The parts contained in engagement part 4, such as the positive and negative pressure valves, etc., are not explicitly depicted because they are not part of the subject matter of the present invention.

FIGS. 2 and 3 show only grip portion 7 of tank cap 3, a coupling cylinder 10 being present that which extends centeredly into grip flange 8 and ensures a nonrotatable connection between grip portion 7 and engagement part 4. Grip portion 7 is made of an electrically conductive plastic, for example of polyamide containing graphite particles. Diametrically opposite contact projections 12, 13, which are also made of an electrically conductive plastic, are molded onto the inner side of lower cylindrical segment 11 of grip portion 7. Contact projections 12, 13 are embodied in the manner of lugs or leaf springs, and are joined at vertical edges 14 to cylindrical segment 11 by being molded on. They protrude radially inward from those edges 14, forming counterclockwise ramps (as viewed from above). Contact projections 12, 13 are sufficiently flexible that they can deflect radially outward, in which context they can pivot into recesses 15, 16. Recesses 15, 16 are embodied so that they can completely receive contact projections 12, 13.

Undersides 17, 18 are curved up toward the free end edges 19, forming a radius 20. At the same time, undersides 17, 18 are also rounded off toward the inner sides of contact projections 12, 13. This configuration of undersides 17, 18 of contact projections 12, 13 serves to make contact projections 12, 13 slide as favorably as possible onto tank neck 2 as tank cap 3 is screwed on, while minimizing stress in the vertical direction; and to produce an elongated linear contact between contact projection 12, 13 and tank neck 2. This minimizes the electrical contact resistance there. As tank cap 3 is screwed onto tank neck 2, contact projections 12, 13 are bent radially outward so that in the final position of tank cap 3, they rest under preload against tank neck 2.

What I Claim is:

1. A tank closure (1) comprising a tank cap (3) and an electrically conductive tank neck (2), the tank cap (3) having, for handling thereof, a grip portion (7) made of

electrically conductive material that is in electrical contact with at least one resilient contact projection (12, 13) that is also electrically conductive and, with the tank cap (3) in the screwed-on state, rests against the tank neck (2),

wherein the contact projection or projections (12, 13) is or are shaped onto or molded into the grip portion (7).

2. The tank closure as defined in Claim 1, wherein the contact projection or projections (12, 13) is or are made of electrically conductive plastic.

3. The tank closure as defined in Claim 1, wherein the grip portion (7) is made of electrically conductive plastic.

4. The tank closure as defined in Claim 2, wherein the contact projection or projections (12, 13) are molded onto the grip portion (7).

5. The tank closure as defined in Claim 1, wherein the contact projection or projections (12, 13) is or are embodied in the manner of a leaf spring, and protrude radially obliquely inward.

6. The tank closure as defined in Claim 5, wherein the contact projection or projections (12, 13), viewed in a circumferential direction, protrude radially obliquely inward beginning on the inner side of the grip portion (7).

7. The tank closure as defined in Claim 6, wherein the underside (17, 18) of the contact projection or projections (12, 13) is pulled up toward the free end (19) and chamfered.

8. The tank closure as defined in Claim 5, wherein the inner side of the grip portion (7) comprises, in the region of the contact projection or projections (12, 13), recesses (15, 16) such that the respective contact projection (12, 13) fits into the recess (15, 16) upon radial outward motion.

9. The tank closure as defined in Claim 8, wherein the contact projection or projections (12, 13) is or are respectively shaped on a rim of the recess (15, 16).

10. The tank closure as defined in Claim 1, wherein two contact projections (12, 13), located diametrically opposite one another, are provided.